Abstract Submitted
for the DFD11 Meeting of
The American Physical Society

Coherence Resonance Behavior in Thermocapillary Lithography
NAN LIU, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd. MC 128-95, Pasadena, CA — Interest in alternative means of nanofilm lithographic patterning has focused attention on a number of thin film hydrodynamic instabilities which can spontaneously generate periodic arrays of 3D protrusions. The interface evolution equation, which results from a competition between stabilizing capillary forces and destabilizing external driving forces, are well described by a nonlinear, fourth order PDE rather sensitive to initial and boundary conditions. Even small levels of noise result in arrays prone to variations in array pitch and array height at levels currently unacceptable for commercial applications. In this talk, we focus on thin film patterning by thermocapillary forces. We demonstrate how an adjacent cooled template with a small sinusoidally roughened surface presented to the free surface of a molten nanofilm can be used to trigger very rapid and uniform array growth with a pitch even smaller than predicted by linear stability analysis. This behavior is reminiscent of coherence resonance phenomena in which a small amount of external noise can trigger resonant uniform growth. We quantify the behavior of waveforms generated in this way by a combination of weakly non-linear analysis and finite element simulations.

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Date submitted: 15 Aug 2011 Electronic form version 1.4